

PATENT ELUCIDATION FOR CLIL AND VICE VERSA UNDERSTANDING THE INVENTOR'S MIND

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Abstract

In this paper we present an English-medium instruction (EMI) team-teaching initiative to be soon implemented within the Agronomic Engineering masters programme at the Technical University of Madrid (UPM). Through the patent genre we not only intend to teach specific agronomical syllabi contents synchronically and diachronically, but also broaden our students' academic and professional literacies, help them practice and improve their communication abilities in English as a lingua franca, and motivate them as future autonomous professionals while fostering the exercise of higher-level transversal skills—critical thinking, creativity, cooperation, and entrepreneurship. We begin by introducing the current mobility trends in higher education contexts and the common misconceptions surrounding the notion of patent, and get on to describe the design and evaluation procedures of the course. To conclude, we recapitulate the main benefits of our pedagogical proposal and open windows onto further didactic applications.

Keywords: education, engineering, collaborative learning, life-long learning, literacy.

1 INTRODUCTION: THE RISE OF STUDENT MOBILITY IN HE SETTINGS

Thanks to communication technologies (ITC), cross-border higher education is likely to increase both its scope and impact in the next decades. According to the report "Higher education in times of change: New Dynamics for Social Responsibility" (GUNI, 2009), the number of international students in 2004 (2.4 million) was three times as much as in 1980. This seems to be an unstoppable trend, since sources such as the report on student mobility "Student Mobility Global 2025 Report" (Brown et al., 2003) and the aforementioned GUNI document (Global University Network for Innovation) respectively predict that about 7.2 million students will aspire to international education by 2025 and point out the need for youth (estimations speak of at least 40-50% of people between 18 and 23) to participate in higher education so as to ensure sustainable development.

The 2009 GUNI report recalls that the purpose of education is to transform rather than transmit and to offer an opportunity to "light the fire" rather than "fill a container". These reflections, minted by the Irish poet Yeats, urge us to reconsider the central purpose of HE educational institutions, which explicitly and progressively should facilitate a reflective, critical and transformative type of learning conducive to a holistic view of education based on responsible paradigms for living (i.e. 'to be' and 'to get to be'), both as individuals and as communities. One of the tools available to deal with such holistic perspective of education is *collaborative learning*. It assumes that knowledge is socially produced by consensus among peers versed in the issue (Barkley et al., 2007; Finkel 2008) and therefore constructed through talk and agreement. Its major goal is to develop thoughtful, independent and articulate people capable of solving complex tasks by applying divergent thought or creativity strategies and high-level critical thinking while interacting with one another, all of which is inseparable from the challenge of accepting and conciliating student diversity.

With the previous context as backdrop, this paper reflects on the English-medium pedagogical initiative of a group of teachers from the Technical University of Madrid (UPM), who are deeply committed to this sort of international holistic education and at the same time aware of the difficulties it may pose. Their proposal, a STEM team-taught master course on English-written patent analysis, will be examined here as to its potential didactic value and repercussions. It draws on the recent experiences and work of Barreiro et al. (2009a and 2009b, 2010a, 2010b and 2011), Curran et al. (2011), Diezma et al. (2009), García-Castellanos et al. (2009), and Moya González et al. (2011).

Little is known about the effect of Content and Language Integrated Learning (CLIL) on university students. Aguilar and Muñoz (2014) studied a large set of over 100 students during a 60-hour regular

engineering course, and showed that CLIL makes the most of learning for students with intermediate language level which is the most frequent case at Spanish universities; where improvement in language was restricted to improved performance in listening with no effect on writing. In the aforementioned study no decrease of content convey rate was found when comparing L1 (mother tongue, Spanish) and L2 teaching (English).

A major objective in this work is to design a course that would allow improving both the writing as well as the listening skills, and to bring linguistics into the core of engineering skills and information literacy.

2 PROBLEM STATEMENT: THREE COMMON MISCONCEPTIONS REGARDING PATENTS

Our teaching experience has led us to use the analysis of English-written patents in the classroom, as a pedagogical tool serving a fourfold purpose: 1) Explain the history of technology through the different discoveries, achievements and inventions registered as intellectual property, 2) Provide future engineers with the conventions of a genre that is today crucial to their careers, both in academic and professional environments, 3) Reinforce the learners' reading and writing abilities in English as a lingua franca, and 4) Foster transversal skills such as critical thinking, creativity, and entrepreneurship, as well as achieve a motivational atmosphere.

To meet the previous objectives, however, it is firstly necessary to eradicate three major misconceptions associated with the notion of patent (Sancho Guinda 2012): one is that it is a static and rigid text, of an impersonal nature and exclusively descriptive. Another wrong belief concerning the patent genre is that it requires acquiring new mental schemata and rhetorical structures to be mastered. And the last fallacy is that patents are, by principle, very precise documents that do not allow for vagueness. In actual fact, though, patents do provide leeway for flexibility (that is, for subjectivity, idiolects and variation), can be learnt by contrast with the research article, and contain a considerable proportion of vague terms, references and explanations so as to prevent competitors from patenting improvements or derived ideas. What seems to make the patent text difficult, in sum, is not so much writing in English or using specific phraseologies, but the absence of a systematic rhetorical framework at the technical faculties.

In addition, engineering instruction demands the use of specific languages with varied formats that enable professionals with different technical and linguistic backgrounds to communicate across disciplines. Patents exemplify this trend perfectly, as they transmit knowledge not only verbally but also graphically through diagrams and schemes—of hydraulic, pneumatic, electrical and mechanical elements, among others—that constitute universal codes. Consequently, patents constitute complex documents of a multidisciplinary nature but also deeply rooted in the scientific tradition. Thus, technical professionals and engineering students alike would feel less intimidated by patent writing if they realized the circular relationship between this genre and the research article, because patents may conduce to more discoveries and research articles to subsequent inventions.

3 COURSE DESIGN

The strategic value of patents at a methodological level turns them into ideal teaching and learning resources that exercise several skills simultaneously: the diachronic study of patents related to a particular development invites students to review technical predecessors as well as to foresee subsequent non-disruptive steps. To obtain a synergic learning effect, this effort may be combined with the analysis of scientific papers directly related to the reviewed patents. The focus, moreover, can be shifted from technical content to form: How are inventions/discoveries reported? Learners may note different story-telling traditions across national cultures and disciplines, and over time. All in all, we propose the synchronic and evolutionary study of patents, from a double discursive and technical perspective, as a life-long learning aid for engineering students, practitioners, and professors—to cope with the fast and continuous changes of our society.

The course is structured into five units (60-90 minutes) involving daily homework.

- Unit 1: Contrast between patent and research-article abstracts: number and types of rhetorical moves, nature of the information. A chicken-or-egg story?
- Unit 2: Comparison of visual information in patents and research articles: graphs, diagrams, accuracy of results, hidden data. What is emphasized and what is assumed?

- Unit 3: Content organization and promotional language in patents and research articles: novelty, utility, inventive steps, and credibility.
- Unit 4: Nature and utility of patent claims: hierarchies and operative keywords. How to associate the description of the invention with its legal claims (which lead students to acknowledge the legal nature of the document).
- Unit 5: Writing your own claims: selection of proper operative keywords, construction of claims from a hierarchy tree, writing of abstracts and claims from photographs of devices.

As can be seen in the above sequence of didactic units, genre awareness is gradually raised by means of contrast and reflection and by combining tasks of identification and production. The starting point is *shared knowledge* (i.e. the comparison of the patent genre, most probably unknown to students, with the research article, a more familiar type of text) whereas unusual content, such as the features of legal language, is reserved to the end of the course. In addition, the very essence of patents, both verbal and visual, fosters different learning styles, an important aspect of classroom diversity. There is also a progression from the explicit to the implicit and from the real to the hypothetical: students are confronted with questions of the type ‘*What if...*’ regarding visual and verbal explicitness and the expression of legal claims, and asked to play with alternatives and make predictions concerning competitors’ reactions and legal effects.

The materials chosen (two U.S. patents and their ‘twin’ research articles) deal with agronomical content (in particular with agricultural devices) as the course will be first given within the masters programme of the Technical School of Agronomic Engineering. Promotional language will be analyzed in a hands-on fashion with the aid of a concordance computer program to show learners the patterns of occurrence of certain terms and lexico-syntactic clusters and track their appearance in different sections of the document.

4 COURSE EVALUATION

Patent analysis may be regarded as a specific case of critical thinking that gathers a combination of high-order cognitive skills (e.g. identification, conceptualization, synthesis, systemic thought, explanation, criticism, prediction, research, extrapolation, etc.) ruled in turn by metacognition, another higher-level skill per se. Rubrics play a key metacognitive role and constitute decisive instruments for evaluation in a multiple sense—*conceptual, communicative, and introspective*.

- Conceptually, rubrics may check what engineering gaps remain to be bridged, whether explanations and predictions are valid and technical solutions and strategies feasible and optimal.
- From a communicative standpoint, rubrics may appraise how concepts are expressed (implicitly, explicitly, tentatively or promotionally), the use learners make of the language (more or less formal, more or less reader-considerate, more or less correct and comprehensible). They will refine the learners’ ‘sense of an audience’ and make them bear in mind who they are reading from
- Under an introspective criterion, rubrics enable students to trace their own learning progress as to the practice of critical thinking and learning strategies (Van Loon and Lai 2014) and the acquisition and handling of relevant linguistic structures typical of the patent text.

Rubrics are besides negotiated, which strengthens the cooperative spirit of the course and encourages the tolerance necessary to scaffold any kind of learning process, and permit a participative peer-to-peer assessment that may involve discussions of technical problems and even text editing. The type of students engaged in this seminar is similar to that of the MOOCs in that their provenance, educational and cultural backgrounds, interests, pursued standards and linguistic abilities may be dramatically different, which could become an obstacle. To make up for this possible disparity, novel self-evaluating tools can be employed, such as advanced checklists and mapping tools (Wilkowski et al. 2014), as well as team-designed blogs and wikis in which students design an ideal patent or list the essential features a model sample of the genre should have. Wordle maps, for example (see Figure 2), are open toys for generating “word clouds” from any given text (Jonathan Feinberg, 2010). The clouds give greater prominence to words that appear more frequently in the source text, and can be tweaked with different fonts, layouts, and colour schemes (<http://www.wordle.net/>).

- It allows the practice of critical thinking to distinguish what information should be tacit and overt, what to conceal and disclose.

But most importantly, patents connect higher education institutions with the real world by pointing to current technological needs while motivating learners, broadening their information literacies, and increasing their autonomy when having to face professional documents.

REFERENCES

- [1] Aguilar, M. and Muñoz, C. (2014). The effect of proficiency on CLIL benefits in Engineering students in Spain. *International Journal of Applied Linguistics*, 24: 1–18. doi: 10.1111/ijal.12006
- [2] Barkley, E. F., K. P. Cross, Major, C.H. (2007). *Técnicas de aprendizaje colaborativo*, Ed. Morata. ISBN 9788471125224.
- [3] Barreiro, P.; Moya, A.; Diezma, B. (2011). *Allegro ma non troppo: las dimensiones ocultas en la coordinación de estudiantes*. VI Jornadas Internacionales de Mentoring and Coaching Universidad Empresa. 22-24 noviembre, CEI Moncloa, Madrid.
- [4] Barreiro, P.; Diezma, B.; Moya-González, A.; Valero, C. (2011). How deep is our knowledge: deceptions and reflections. *The 5th International Multi-Conference on Society, Cybernetics and Informatics*. July 19—22, 2011, Orlando Florida. Volume 1: 17:20.
- [5] Barreiro, P. (2010a). *Relación Universidad empresa en el marco de Bolonia*. VIII jornadas sobre la actividad docente e investigadora en ingeniería agroforestal. Sevilla 22-24 septiembre, 2010.
- [6] Barreiro, P.; Diezma, B.; Valero, C. (2010b). *Aplicación de las técnicas de aprendizaje colaborativo en el grado de ingeniero agrónomo (agricultura de precisión) y máster de Agroingeniería (robótica aplicada)*. VIII jornadas sobre la actividad docente e investigadora en ingeniería agroforestal. Sevilla 22-24 septiembre, 2010.
- [7] Barreiro, P.; Recio, B.; Méndez-fuentes; Morató, M.C.; Ramirez, E. (2009a). *AGROTECH09: building agricultural robots with lego mindstorm. A multidisciplinary and multicultural approach*. Edulearn. International Association of Technology. Education and Development. Barcelona. July 6-8, 2009.
- [8] Barreiro, P.; Diezma, B; Recio, B.; Fuentes-Mendez, V. (2009b). *Fitting into their shoes: how robots help multidisciplinary approaches under cooperative learning*. ABP workshop. Universidad Autónoma de Madrid. June 22-23, 2009.
- [9] Brown, J., Bohm, A., Pearce, D, Meares, D. Davis, D., Hewett, A. (2003). *Global Student Mobility 2025: The Supply Challenge*. ISBN: 0864030525.
- [10] Cipolla, C.M. (2001). *Allegro ma non troppo*. Ed. Crítica. ISBN 8484322270.
- [11] Curran Thomas P., Barreiro Pilar, Vox Giuliano, A. Dillaha Theo, C. Zahos, Stephen, and S. Gates Richard. (2011). *Undergraduate Design Experiences in the Trans-Atlantic Biosystems Engineering Network (TABE.NET)*. 2011 Louisville, Kentucky, August 7-10, 2011.
- [12] Diezma, B., M.C. Morató, P. Barreiro, B. Recio, V. Méndez-Fuentes, E. García Moutón, E. Martínez, M.T. Castellanos, M.V. Castellanos, M. Flórez. (2009). *Multidisciplinary excersices. Coordination and application from fundamental to applied subjects in agricultural engineering*. International Association of Technology. Education and Development. Barcelona July 6-8 2009.
- [13] Feinberg J. (2010). *Beautiful Visualization. Looking at Data through the Eyes of Experts*. Chapter 3: Wordle. Ed. O`Reilly Media. ISBN:978-1-4493-7986-5.
- [14] Finkel, D. (2008). *Dar clase con la boca cerrada*. Ed. Universidad de Valencia. ISBN 9788437072685.
- [15] GUNI. (2009). *La educación superior en tiempos de cambio*. Ed. Mundi Prensa. ISBN 9788484763789.
- [16] McCormack, J. P., Beyerlein, S. W., Kranov, A. A., & PE, P. D. P. (2014). *Scenario and Scoring Sheet Development for Engineering Professional Skill Assessment*. 121st ASEE Annual Conference & Exposition. Indianapolis, IN, June 15-18, 2014.

- [17] Moya Gonzalez, A.; Diezma Iglesias, B.; Barreiro Elorza, P.; Ortiz-Cañavate Puig-Mauri, J.; Valero Ubierna, C. 2011. El análisis de actividades en el entorno virtual de aprendizaje de la UPM como herramienta previa a la generación y distribución de objetos de aprendizaje estándar (SCORMS). In: VI Jornada de innovación pedagógica ADA-Madrid, 29/04/2011, Madrid, España.
- [18] Sancho Guinda, C. (2012). Flexibility features in patent writing. *Ibérica 24* (Revista de la Asociación Europea de Lenguas para Fines Específicos AELFE) Fall Issue (2012), 185-210. ISSN: 1139-7241.
- [19] Van Loon, James E. and Lai, Heather L. (2014). Information Literacy Skills as a Critical Thinking Framework in the Undergraduate Engineering Curriculum. Library Scholarly Publications. Paper 80.
- [20] Wilkowski, L., Deutsch, A., Russell, D.M. (2014) L@S '14 Proceedings of the first ACM conference on Learning @ scale conference. Pages 3-10. ISBN: 978-1-4503-2669-8.